

ANNOTATIONES ZOOLOGICAE JAPONENSES

Volume 25, Nos. 1, 2—January 1952

Dr. Yô K. Okada Jubilee Numbers

Published by the Zoological Society of Japan
Zoological Institute, Tokyo University

Three New Species of Bathynellidae (Syncarida) found
in Subterranean Waters of Japan¹⁾

With 6 Text-figures

Masuzo UÉNO

Otsu Hydrobiological Station, University of Kyoto

The most primitive Malacostracan division Syncarida is represented by four species inhabiting freshwaters of Tasmania and southern Australia, and by six other species found in subterranean waters of Eurasia, five in Europe and one in Malacca. All these peculiar forms are regarded as surviving representatives of an archaic group of Crustacea found in the Permian and Carboniferous deposits of Europe and North America. In this respect the most recent discoveries in Japan of three species belonging to this remarkable group of great antiquity are worthy of notice from the standpoint of freshwater zoögeography.

In the summer of 1950, several specimens of two different kinds of minute crustaceans which appeared to belong to the Bathynellidae were found by Mr. Yoshinobu Morimoto of Himeji Municipal High School in plankton-net catches from a well of the Municipal Water-works of Himeji City. Both forms seemed to be new to science and to belong to the genera *Bathynella* and *Parabathynella* respectively. In December of the same year, Mr. Yoshifumi Miura of Tatsuno High School obtained some more specimens of these two new species from a well of the Municipal Water-works of Aioi City some 15 km west of Himeji City. During his collecting travel in the summer of 1951, Mr. Morimoto succeeded in finding one more aberrant species of *Parabathynella* in a well in Hachioji City, in the west suburbs of Tokyo. These three new

1) Contributions from the Otsu Hydrobiological Station, University of Kyoto, No. 131.

species will be described and discussed below.

The writer wishes to express his cordial thanks to the collectors, Messrs. Morimoto and Miura, for their kindness in placing these interesting specimens at his disposal for examination.

Bathynella Vejdosky

Vejdosky, 1882, p. 65, pl. 8; Chappuis, 1915, p. 147; Calman, 1917, p. 490 ff.; Chappuis, 1927b, p. 604.

Bathynella morimotoi sp. nov. (Figs. 1 and 2)

Body subcylindrical, white in colour, abdomen more bulky than thorax and slightly compressed; eight thoracic and six abdominal somites distinctly articulated; cuticle thin and translucent.

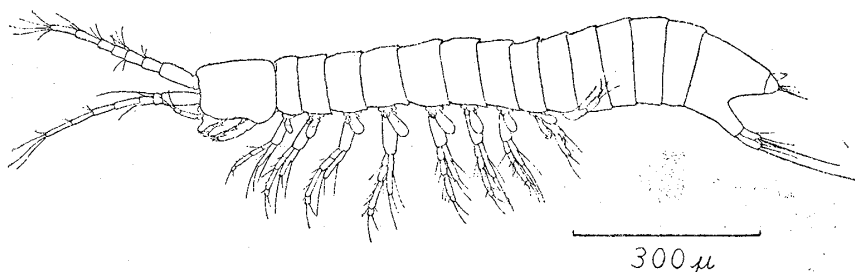


Fig. 1. *Bathynella morimotoi* sp. nov. ♀ from Himeji.

Head longer than wide, truncated in front, no trace of rostrum, clearly defined from first thoracic somite; on side a shallow groove running from base of mandible obliquely upwards and backwards, but not reaching dorsal surface of head. Eyes entirely wanting. Antennule seven-jointed, biramous, a minute vestige of inner ramus or endopodite attached to distal end of third or last joint of peduncle. Antenna consists of seven joints; peduncle two-jointed, longer first and short second, the latter of which bears a small unjointed outer ramus or exopodite tipped with a long seta. Mandible with a well-developed palp of three joints, of which second is longest and two others subequal; incisive part with five saw-teeth. Maxillula with two endites, proximal small, narrow and with three apical setae, distal armed with four spines and one seta, on outer distal side there is present a group of three setae which probably represent a vestige of palp. Maxilla with three endites, provided with setae, three on proximal, two on second, and five on distal respectively; palp short and unjointed.

Eight pairs of thoracic legs, all similarly of biarticulate structure with the exception of last pair which differs greatly in the two sexes; from first to seventh pair becoming shorter in passing backwards along series of legs. Coxopodite short, bearing two epipodites on its outer

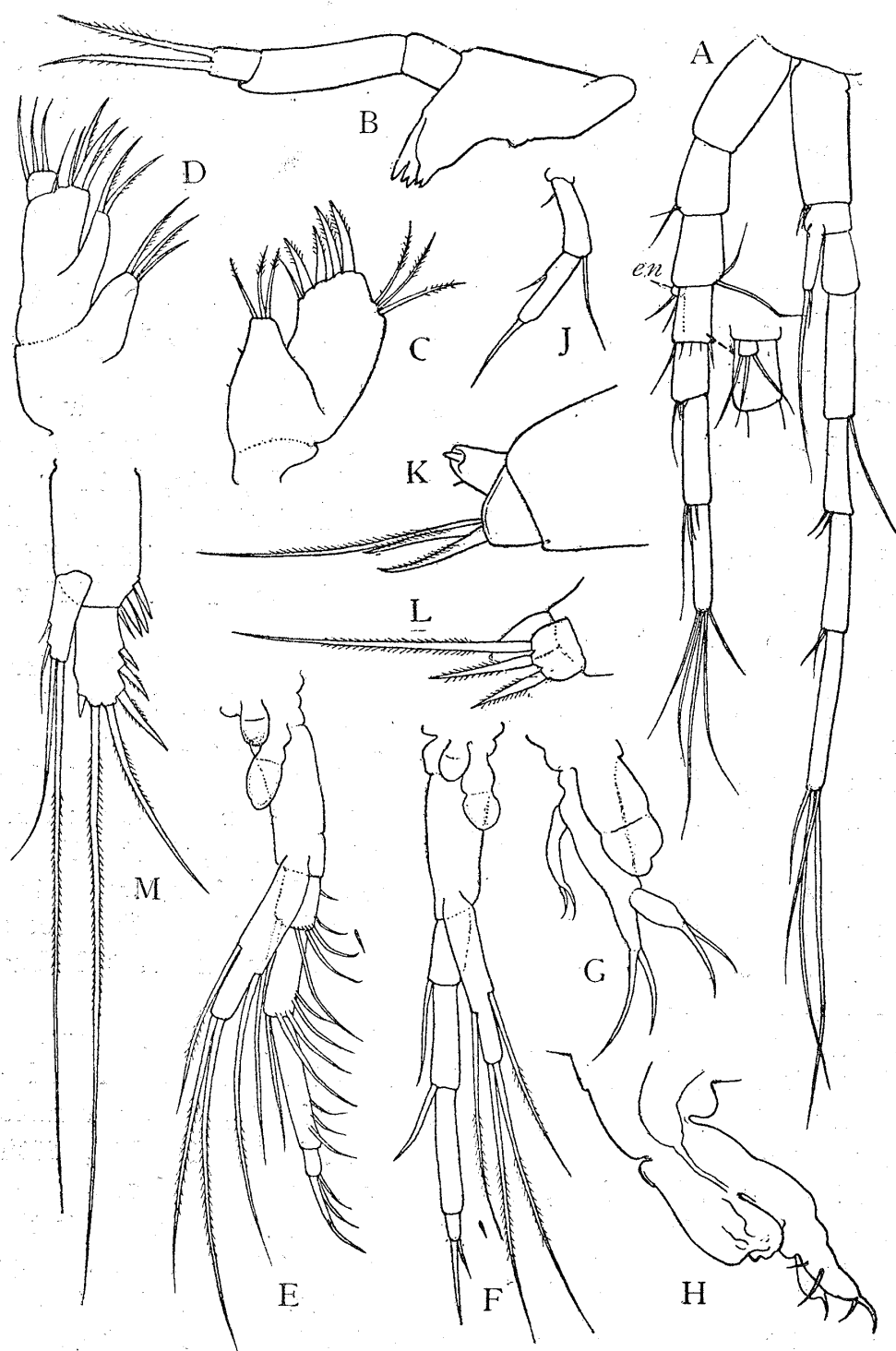


Fig. 2. *Bathynella morimotoi* sp. nov.

A. antennule and antenna, ex—exopodite, en—endopodite; B. mandible; C. maxillula; D. maxilla; E. left third thoracic leg, ex—exopodite; F. left sixth thoracic leg, ex—exopodite; G. left eighth thoracic leg of female; H. left eighth thoracic leg of male; J. left first pleopod; K. telson, side view; L. telson, seen from below; M. left uropod, en—endopodite.

surface; basipodite with unjointed exopodite and four jointed endopodite, former provided with a long seta on each side and with two long setae at apex; first four or five pairs, endopodite provided with an oblique row of setae on distal end of hind face of each joint respectively, first and second joint of each pair with a seta on distal end of frontal side. Of two epipodites on each leg, distal is oval vesicle, not flattened, crossed by a suture line at about middle of its length; proximal one half size of distal, similarly oval in shape, but not constricted at base.

Last or eighth thoracic leg of male differs markedly from preceding pairs; coxopodite changed to a papilla-like thick process prolonged in a direction nearly parallel to basipodite, among which genital duct opens; endo- and exopodites rudimentary, no epipodite. Eighth pair of female with only one epipodite, unjointed exo- and endopodite, both of which have two setae at apex; on frontal face of basipodite bears a small lobe tipped with two setae. This lobe may assist the process of fertilization in same way as illustrated by Smith (1909) in the female hinder legs of *Paranaspides lacustris* of the order Anaspidacea.

Pleopods present only on first abdominal somite; short, uniramous and two-jointed. Uropods or appendages of sixth abdominal somite very short; peduncle large and compressed, armed with a row of from four to six spines on inner distal margin; endopodite subcylindrical, with four spines and two setae distally, of which longer one is six times as long as endopodite itself; exopodite elongated conical, shorter than endopodite, and with two long setae. Telson divided into two parts wide apart; each part short, conical when seen from side, with three setae distally, and also with a pointed papilla-like process erected obliquely upwards and backwards.

Length of body: 1.0–1.3 mm. in both sexes, rarely 1.5 mm.

Localities: Well of the Municipal Water-works of Himeji City, Hyogo Prefecture, August 1950, coll. by Morimoto, *type* one male and one female; well of the Municipal Water-works of Aioi City, 20th December 1950, coll. by Miura, six males and seven females.

Remarks: This species closely resembles in many respects the two known species, *Bathynella natans* Vejdovsky (1882) and *B. chappuisi* Delachaux (1926), but differs from them in the characteristics of the uropods and telson. In the present species the outermost one of the apical setae of the telson is the longest, while in the other two these setae are either nearly equal in length (*B. chappuisi*) or the middle one is much longer than the others (*B. natans*). In *B. natans* each thoracic leg has two epipodites with the exception of the last pair, while in *B. chappuisi* there is only a single epipodite. In this feature

B. morimotoi is more closely related to *B. natans* than to *B. chappuisi*. In the character of the genital papilla of the male eighth thoracic leg the present species is allied to *B. chappuisi*.

Chappuis (1915) points out that in *B. natans* the peduncle of the antenna consists of three joints, and his view is supported by Calman (1917). In the present new species, however, the peduncle of the antenna apparently consists of only two joints, no additional one being found. In this respect *B. morimotoi* corresponds well to the known living Syncarida other than *B. natans*, and agrees, in this character, with the Mysidacea and many other Peracarida.

Parabathynella Chappuis

Chappuis, 1926, p. 7-10, 1927b, p. 604.

Parabathynella miurai sp. nov. (Figs. 3 and 4)

White and delicate animal of worm-like form that recalls some types of the Harpacticoid Copepoda. Body elongated, subcylindrical, not becoming bulky behind as in *Bathynella morimotoi*. Head, eight thoracic and six abdominal somites distinctly segmented, each thoracic somite much shorter than hinder abdominal somites; cuticle thin, translucent, and surface with dense minute punctuation.

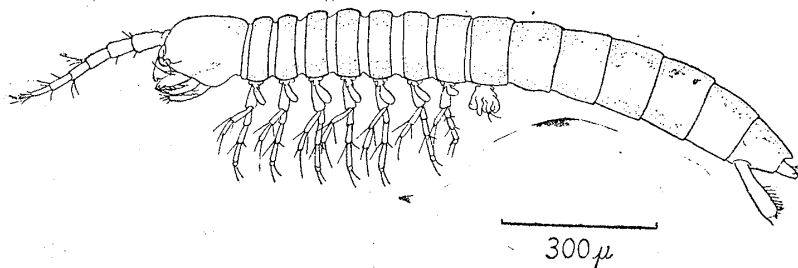


Fig. 3. *Parabathynella miurai* sp. nov. ♂ from Himeji.

Head a little longer than wide, no rostral projection, definitely segmented from first thoracic somite; mandibular groove on side hardly visible. Eyes entirely absent. Antennule rather robust, consisting of six joints, three of which form peduncle; a minute vestige of unjointed inner ramus or endopodite with three apical setae present on distal end of peduncle. Antenna rudimentary, consisting of only two very short joints, distal curved behind and provided with two apical setae. Labrum large, with a row of teeth on distal margin. Mandibular palp short and unjointed, with a single apical seta; incisive part of mandible armed with three tooth-like processes, no molar developed. Maxillula slender,

well-chitinized, proximal endite ending in a large spine and two or three short setae, distal endite armed with five incurved spines, apical

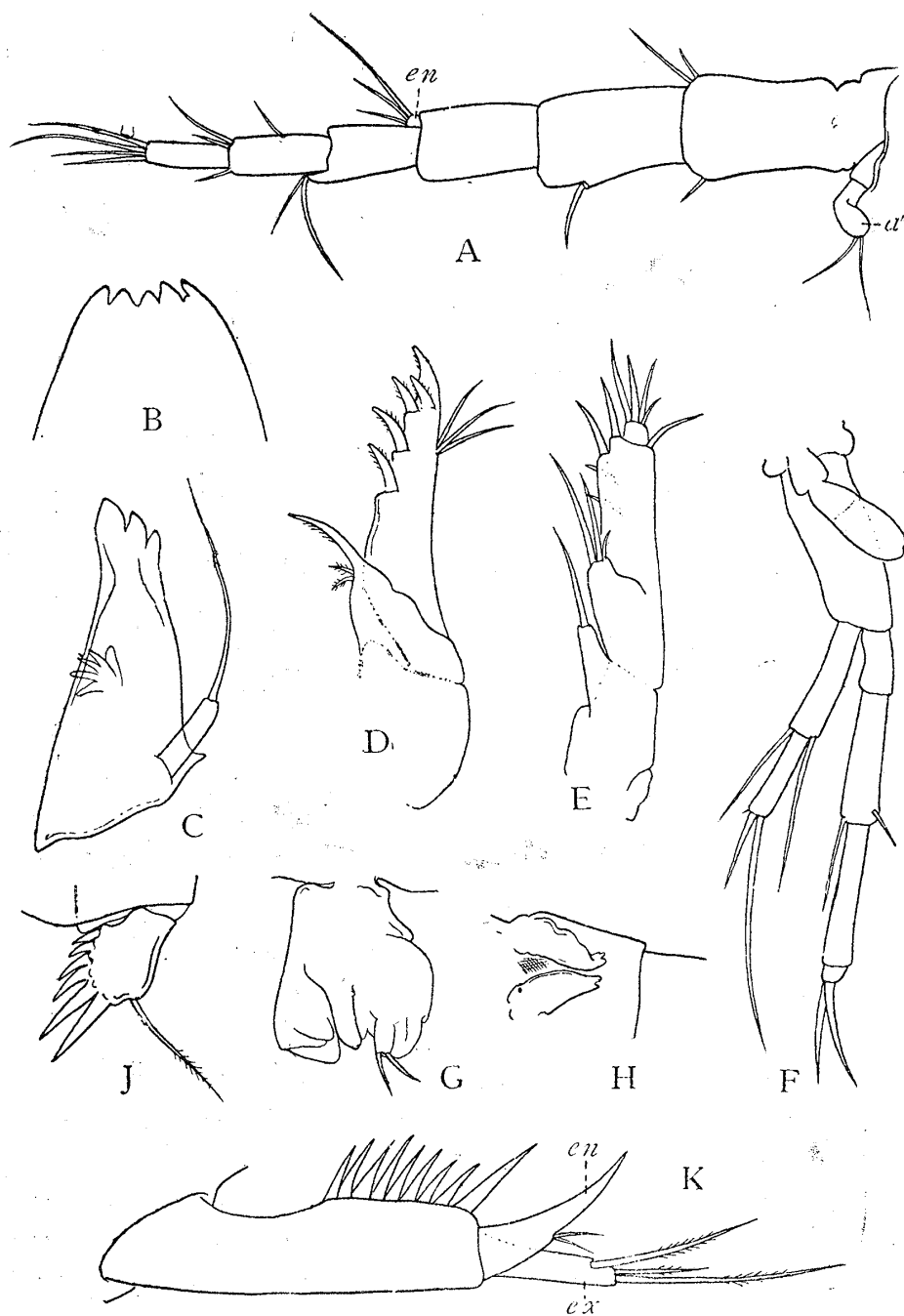


Fig. 4. *Parabathynella miurai* sp. nov.

A. antennule and antenna (a''), en—endopodite; B. labrum; C. mandible; D. maxillula; E. maxilla; F. left thoracic leg; G. eighth thoracic leg of male; H. eighth thoracic leg of female; J. telson, dorsal view; K. uropod (right), seen from inner side.

one of which is the largest; on outer distal side there is present a group of three setae which probably represents a vestigial palp. Maxilla with three endites, of which proximal bears one, and middle, two or three apical setae; distal armed with two or three spines; palp short and unjointed.

Of eight pairs of thoracic legs, seven all alike, of biramous construction; basipodite bears four-jointed endopodite and two-jointed exopodite, last or fourth joint of endopodite shortest and provided with two nearly subequal apical setae; one of two apical setae of exopodite nearly as long as or slightly longer than all exopodite joints together; one epipodite present on outer side of coxopodite, flattened, with a hardly visible transverse suture line. Last thoracic legs of male, exopodite reduced to a papilla, endopodite tipped with two setae, no epipodite present, coxopodite produced in a rounded prominence so as to enclose both endopodite and exopodite. Last thoracic legs of female rudimentary, forming a pair of chitinous processes directed backwards and close to sternite. No pleopods.

Hind margin of tergite of sixth or last abdominal somite concave, forming anal opercle. Telson composed of a pair of laminae; each ramus of laminae fringed on inner margin with six stout spines which increase in length distally and also with a single seta on outer side near distal end. Uropods large and stout; peduncle long, laterally compressed, on distal half of inner side armed with a row of nine spines, of which most distal one is the longest; exopodite slender, about half as long as peduncle, and with four setae; endopodite very short, chela-like, curved inwards, bearing two setae on outer side.

Length of body: 1.3–1.5 mm. in male, 1.3 mm. in female.

Localities: Well of the Municipal Water-works of Himeji City, Hyogo Prefecture, August 1950, coll. by Morimoto, *type* one male and one female; well of the Municipal Water-works of Aioi City, Hyogo Pref., Aug. 1950, coll. by Miura, three males and two females.

Remarks: The present new species resembles closely *Parabathynella stygia* Chappuis (1926) from Serbia of Yugoslavia, but differs from it in the features of the thoracic legs, telson and uropods. In *P. stygia* the telson has four spines and two setae and the peduncle of the uropod bears only four spines, while in *P. miurai* there are six spines on the telson and nine spines on the peduncle of the uropod. *P. stygia* has only five pairs of thoracic legs, but *P. miurai* has, on the contrary, seven pairs of well-developed biramous thoracic legs and a rudimentary eighth pair also. In this respect, the present new species is much more closely allied to the Malayan *P. malaya* G.O. Sars (1929; Chappuis

1927b, p. 604) which has seven pairs of thoracic legs of all similarly constructed, three-jointed exopodites, and has also a rudimentary eighth pair.

Parabathynella carinata sp. nov. (Figs. 5 and 6)

Body elongated, compressed, more robust than in *P. miurai*, greyish white, somewhat translucent. Eight thoracic and six abdominal somites distinctly segmented; back of each somite curved and carinated, carina of four anterior somites not forming any projection, but that of succeeding somites becomes an elevated, laminar, posteriorly pointing projection; last somite likewise carinated, produced to an acute projection extending to level of tip of telson.

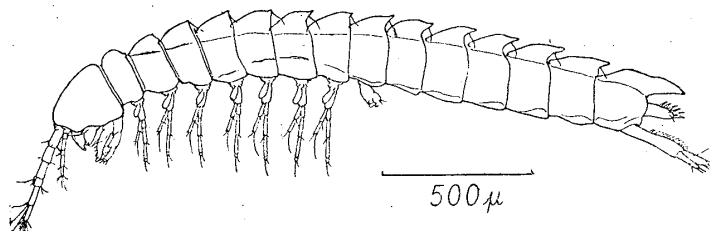


Fig. 5. *Parabathynella carinata* sp. nov. ♂ from Hachioji.

Head a little longer than wide, distinctly segmented from first thoracic somite, no rostral projection, emarginate on ventral margin, with a mandibular groove on side. Eyes entirely wanting. Antennule rather robust, six-jointed, a vestige of endopodite tipped with three setae present on distal end of third or last joint of peduncle. Antenna half as long as, and much slenderer than antennule; uniramous, consisting of six joints. Mouth-parts have the characters peculiar to the genus *Parabathynella*.

Of thoracic legs, six pairs all alike in biramous construction; only a single epipodite on outer surface of coxopodite, oblong-ovate in outline, crossed by a suture line about middle of its length; basipodite bears two-jointed exopodite and four-jointed endopodite, both of which have two apical setae respectively, one long and thick, and the other short and fine. In eighth thoracic leg of male, exopodite reduced to a papilla and endopodite tipped with two setae; eighth thoracic leg of female rudimentary, forming only a small round protuberance. No pleopods present.

Each lobe of telson armed with a row of six stout spines on inner distal margin. Uropod long and robust; peduncle elongated, somewhat compressed, armed on inner dorsal margin with a row of fifteen large spines; exopodite nearly one-fourth as long as peduncle, with two long

terminal setae; endopodite a little longer and thicker than exopodite, with one small and two large tooth-like spines and three setae at apex.

Length of body: 2.2 mm. in male, 2.0 mm. in female.

Locality: One male and one female, collected by Morimoto on July 25th, 1951, from a well in the City of Hachioji west suburbs of Tokyo.

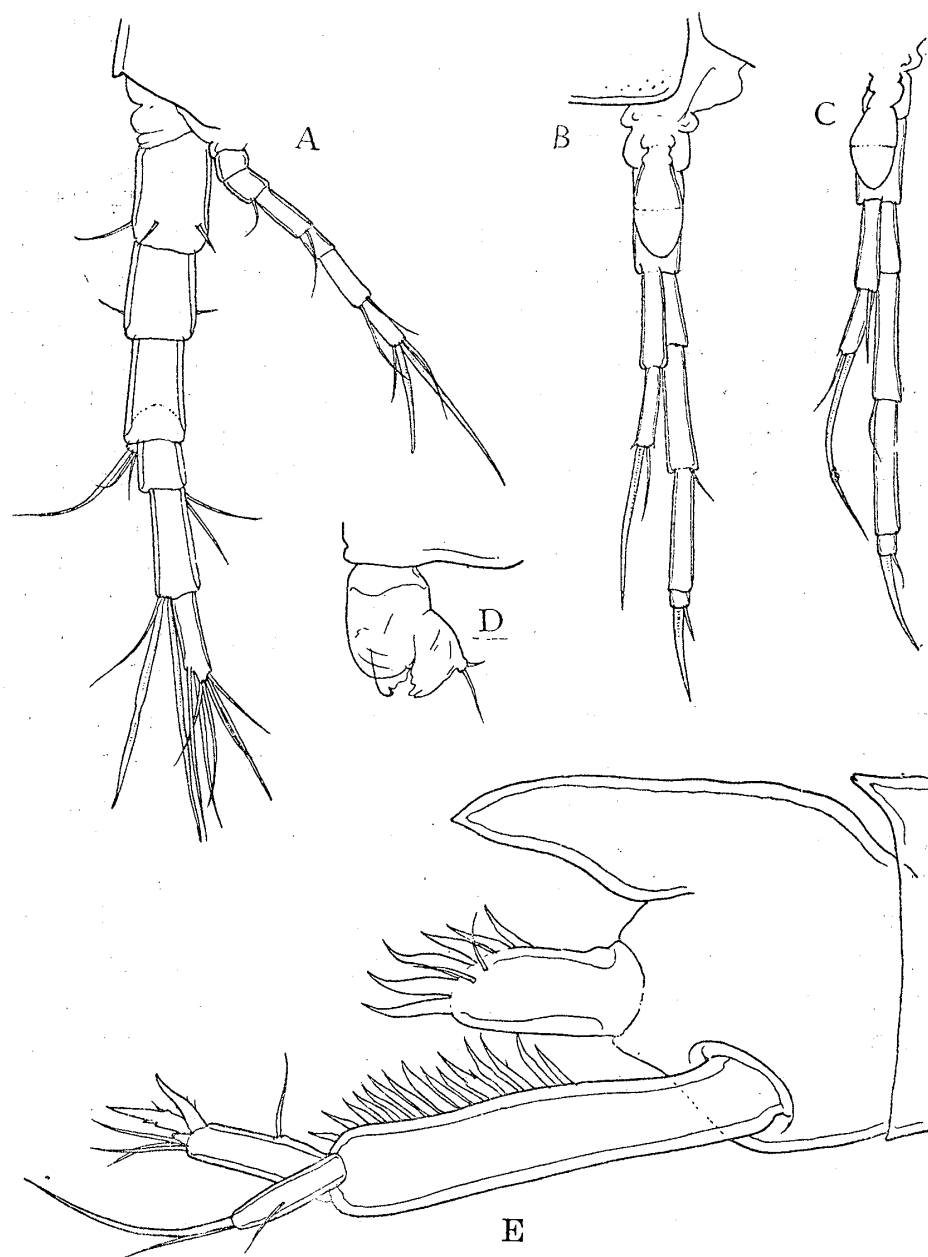


Fig. 6. *Parabathynella carinata* sp. nov.

A. antennule and antenna; B. left fourth thoracic leg; C. left seventh thoracic leg; D. eighth thoracic leg of male; E. telson and uropod, right side.

Two more specimens, one male and one immature individual, from the same locality by Miura in September, 1951.

Remarks: This species differs from the preceding species, *P. miurai*, in having a prominent carina on each somite and multijointed antennae, and in the features of the uropods and telson. This species is the largest in body length in the genus *Parabathynella*. The species hitherto known to the genus do not exceed 1.5 mm. long, the genotypical species *P. stygia* measuring only 0.7–0.8 mm.

Some Additional Notes

1. Bathynellidae consist of two genera found in subterranean waters of both Europe and Malacca, as mentioned already. One of those, *Bathynella* has two species, viz. *B. natans* Vejdovsky and *B. chappuisi* Delachaux. The former occurs in Poland, Germany and Switzerland, and the latter is found in Germany, Switzerland and England, and also in several places in the Balkan Peninsula. The other genus *Parabathynella* has an even more scattered and discontinuous range. Besides the two species from eastern Europe, *P. stygia* Chappuis from Serbia and *P. phreatica* Chappuis from Macedonia (cf. Thienemann, 1950, p. 176), the third species *P. lucitanica* Braga has been described from Portugal. More recently, a species which is either identical with or very closely allied to *P. phreatica* has been reported from a cave near Palma of Mallorca, Spanish Balearic Is. (Margaleff, 1951, p. 151–153). One more species, *P. malaya* G. O. Sars, penetrates into districts as far east as the Malay Peninsula (Batu Cave of Selangor). Throughout the greater part of Asia no Bathynellidae excepting *P. malaya* are found until Japan, where there occur isolated colonies of three species, *B. morimotoi*, *P. miurai* and *P. carinata*, which are described in the present paper. The discoveries of these Japanese species suggest that more living members of Syncarida may still be found anywhere in the temperate freshwaters of Eurasia outside of Europe. No Bathynellidae are found in any parts of North America. Consequently, the following nine species are now known to the family Bathynellidae:

Order Bathynellacea Chappuis, 1939

Family Bathynellidae Grobben, 1904

1. *Bathynella natans* Vejdovsky, 1882
2. *B. chappuisi* Delachaux, 1920
3. *B. morimotoi* Uéno, sp. nov.
4. *Parabathynella stygia* Chappuis, 1926
5. *P. malaya* G. O. Sars, 1929

6. *P. phreatica* Chappuis, 1939

7. *P. lucitanica* Braga, 1949

8. *P. miurai* Uéno, sp. nov.

9. *P. carinata* Uéno, sp. nov.

2. It is notable that both species, *B. morimotoi* and *P. miurai*, were pumped up together from the same well in Himeji. At the same time, there were found in this well four blind species of Copepoda, one belonging to *Eucyclops* and the other three to *Diacyclops* (Ito, MS), and also an amphipod *Pseudocrangonyx* and an isopod *Caecidotea*. The proper habitat of these peculiar animals is not actually this well, but no doubt includes the subterranean reservoirs and streams intercommunicating over extensive areas of this region. The well in which these bathynellids are occasionally taken up is located on the alluvial plane, but the underground channels by which the well is fed are supposed to extend over the surrounding Palaeozoic formations. This conceivably vast water system may contain a peculiar assemblage of blind crustaceans which sometimes become accessible to us in wells. This assumption was partly ascertained by the finding of the second locality of both species of Bathynellidae in Aioi some 15 km west of Himeji. The location and geological condition of that well are closely similar to those of the Himeji City well.

3. The known species of Syncarida are exclusively freshwater inhabitants, even most of the fossil forms as well. It is evident that they had already become adapted to freshwater habitats in very ancient times. All the nine species now known to the order Bathynellacea have probably been derived from a common stock of ancestral forms and must have reached their present habitats when the distribution of land and sea was very different from that at present. However, the derivation of Bathynellidae in Japan, which is quite isolated from the known habitats, is not so easy to understand. It is reasonable to suppose that, as Spandl (1926, p. 61) pointed out in the European species of *Bathynella* (cf. also Thienemann 1950, p. 214), they are in the nature of relics of an ancient freshwater fauna, or preglacial relics in the faunae of subterranean waters of Japan. The occurrence of the third species, *P. carinata*, in Hachioji on the elevated land west of Tokyo has suggested that the bathynellid species may be distributed rather widely in Japan.

4. As is well known, Syncarida consist of five families, three living and two fossil. Of the three living families, Anaspididae and Koonungidae of Anaspidacea, another order of Syncarida, are restricted to certain bodies of freshwater in Tasmania and southern Australia

(Melbourne). The former consists of three species: *Anaspides tasmaniae* Thomson, *Paranaspides lacustris* Smith and *Micraspides calmani* Nicholls, while the latter is represented by a single species: *Koonunga cursor* Sayce. Their Palaeozoic relatives, Pleurocarididae and Uronectidae, range over Europe and North America, indicating a formerly much wider distribution. The discoveries of Bathynellidae in Japan will fill in the gap existing in their range between Europe and North America, excluding Malacca (the locality of *Parabathynella malaya*). Moreover, the occurrence of such an archaic type in Japan, where there are known only a very few species of such elements¹⁾, will throw light on the problem of the origin and history of the freshwater fauna of Japan.

LITERATURE

- Calman, W. T. 1899. On the characters of the crustacean genus *Bathynella* Vejdovsky. J. Linn. Soc., Zool., vol. 27, p. 338-344.
- 1909. Crustacea. In A Treatise on Zoology, ed. by Sir Ray Lankester. Pt. 7, fasc. 3, p. 162 (Syncarida).
- 1917. Notes on the morphology of *Bathynella* and some allied Crustacea. Quart. J. Micr. Sci., vol. 62, p. 489-514.
- Chappuis, P. A. 1915. *Bathynella natans* und ihre Stellung im System. Zool. Jahrb., Abt. System. und Zoogeogr., Bd. 40, S. 147-176.
- 1926. *Parabathynella stygia*, n. g. n. sp., nouveau crustacé cavernicole de la Serbie. Bull. de la Soc. sci. de Cluj, t. 3, p. 7-10.
- 1927a. Die Tierwelt der unterirdischen Gewässer. In Die Binnengewässer, Bd. 3, herausgegeben von A. Thienemann, Bd. 3, Stuttgart.
- 1927b. Anaspidacea. Kükenthal-Krumbach: Handb. d. Zoologie, Bd. 3, S. 593-606.
- *——— 1939. Ueber *Bathynella* und *Parabathynella*. Vestnik C. Z. Společnosti v. Praze, 617, p. 120-132.
- Ito, Takashi (MS) Subterranean Copepoda from Japan.
- Karaman, Stanko 1935. Die Fauna der unterirdischen Gewässer Jugoslaviens. Verhandl. IVL, Bd. 7, S. 46-73.
- Margaleff, Ramon 1951. Un sincárido del género *Parabathynella* en las Baleares. Publ. Inst. Biol. Appl., Tomo 8, p. 151-153.
- Smith, Geoffroy 1909. On the Anaspidacea, living and fossil. Quart. J. Micr. Sci., vol. 53, p. 489-578.
- Spandl, Hermann 1926. Die Tierwelt der unterirdischen Gewässer. Wien.
- Thienemann, A. 1950. Verbreitungsgeschichte der Süßwassertierwelt Europas; Versuch einer historischen Tiergeographie der europäischen Binnengewässer. Die Binnengewässer, Bd. 18. Stuttgart.
- Vejdovsky, F. 1882. Thierische Organismen der Brunnenwasser von Prag. Prag, pp. 1-70.
- Wagler, E. 1937. Crustacea (Krebstiere). Brohmer-Ehrmann-Ulmer: Die Tierwelt Mitteleuropas, Bd. 2, Lfg. 2a, S. 187-188.
- Wolf, B. 1934. Animalium Cavernarum Catalogus. Vol. 3, p. 63-64.
- Paper marked with an asterisk * was not accessible to the writer.

1) The giant salamander *Megalobatrachus japonicus* (Temminck) is a good representative of this type distributed in Japan.